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(54) LAMINATED FILM FOR DECORATING THREE-DIMENSIONAL MOLDING, ITS MANUFACTURING METHOD AND ITS APPLICATION

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a laminated film for decorating a three-dimensional molding for imparting physical/chemical durability such as excellent followability to a complicated three-dimensional shape, weather resistance, damage resistance, impact resistance, water resistance and the like, and capable of improving design properties including a glossiness.
SOLUTION: The laminate film for decorating the three-dimensional molding having a draw ratio of 1.5 or less is obtained by laminating a clear layer (B) capable of curing by irradiating an electromagnetic beam on a thermoplastic protective film layer (A) and further laminating a colored layer (C) on the layer (B). In this case, the layer (A), the layer (B) and the layer (C) all each has an elongation percentage of 200% or more at 60° C. A thickness of the layer (B) is 0.005 to 0.300 mm. A glass transition point of the layer (B) after irradiation with the electromagnetic beam is 60 to 120° C, and the elongation percentage after the beam is irradiated is 3 to 30%.

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A. Relevance of the above-identified Document

This document has relevance to all claims of the present application.

B. Translation of the Relevant Passages of the Document

[CLAIMS]

[CLAIM 2]

The laminate film for decorating a three-dimensional molded product as set forth in claim 1, wherein:

the clear layer (B) is made of electromagnetic ray hardening clear composed of at least thermoplastic polymer (b1) and multifunctional urethane(meta)acrylate oligomer (b2).

[CLAIM 3]

The laminate film for decorating a three-dimensional molded product as set forth in claim 2, wherein:

the electromagnetic ray hardening clear is further composed of electromagnetic responsive polymerization initiator (b3).

[CLAIM 4]

The laminate film for decorating a three-dimensional molded product as set forth in claim 2 or 3, wherein:

the thermoplastic polymer (b1) has a glass transition point of from 50 °C to 150 °C, and a ratio of the thermoplastic polymer (b1) to the clear layer (B) is from 40% to 95% by mass.

[CLAIM 6]

The laminate film for decorating a three-dimensional molded product as set forth in any one of claims 1 through 5, wherein:

the thermoplastic protective film layer (A) is formed with polyester and/or polyolefin.

[CLAIM 7]

A manufacturing method of a laminate film for decorating a three-dimensional molded product, comprising the steps of:

forming in a sheet shape on a thermoplastic protective film layer (A) by an extrusion machine, a clear layer (B) that can be hardened by irradiation of an electromagnetic ray; and

forming a coloring layer (C) on the clear layer (B).

[CLAIM 8]

A method for decorating a three-dimensional molded product, by use of the laminate film for decorating a

three-dimensional molded product as set forth in any one of claims 1 through 6, the method comprising the steps of:

decorating the three-dimensional molded product so that the coloring layer (C) of the film faces the three-dimensional molded product; and

hardening the clear layer (B) of the laminate film by irradiating an electromagnetic ray.

[CLAIM 10]

··· the electromagnetic ray is at least one ray selected from the group consisting of ultraviolet ray, electron ray, and infrared ray.

[DETAILED DESCRIPTION OF THE INVENTION]

[0004]

[MEANS TO SOLVE THE PROBLEMS]

This revealed that a laminate film having a three-layer structure composed of a thermoplastic protective film layer (A), a clear layer (B), and a coloring layer (C) achieves effects as follows. Namely, the thermoplastic protective film layer (A) protects a surface of the laminate film so as to improve damage resistance; and blocks oxygen which is a factor that inhibits the hardening of the clear layer (B) by an electromagnetic ray so as to improve hardening property and thus achieve excellent weather resistance. Further, the clear layer (B)

imparts physical and chemical durability such as weather resistance, damage resistance, shock resistance, and water resistance; and achieves glossiness so as to protect a tone given by the coloring layer (C) and thus improve the design property. Further, also revealed is that if each of the thermoplastic protective film layer (A), the clear layer (B), and the coloring layer (C) has an elongation percentage of not less than 200% at 60 °C, the laminate film can have excellent suppleness to a complicated three-dimensional shape, thereby realizing good decorating.

[EMBODIMENTS]

[0009]

The film for forming the thermoplastic protective film layer (A) may be known film such as soft vinyl chloride film, unstretchable polypropylene film, unstretchable polyester film, polycarbonate film, acryl resin film, and fluorine film. Among these films, a film formed with polyester and/or polyolefin is preferable, and unstretchable polyester film is more preferable especially in terms of energy-saving processing at low temperature.

[0010]

The clear layer (B) imparts to the decorated molded product, physical and chemical durability such as weather resistance, damage resistance, shock resistance, and

water resistance; and achieves glossiness so as to protect a tone given by the coloring layer (C) and thus improve the design property. The clear layer (B) can be hardened by the irradiation of an electromagnetic ray.

[0011]

The clear layer (B) is preferably formed with an electromagnetic ray hardening clear composed of at least thermoplastic polymer (b1) and multifunctional urethane(meta)acrylate oligomer (b2).

[0012]

The thermoplastic polymer (b1) preferably has a glass transition point of from 50 °C to 150 °C. Specifically, the thermoplastic polymer (b1) may be saturated acrylic resin, saturated polyester resin, polyurethane resin, methyl(meta)acrylate/(meta)acrylic acid copolymer, methyl(meta)acrylate/glycicyl methacrylate copolymer, and acryloyl grafted methyl(meta)acrylate/(meta)acrylic acid copolymer, for example. The multifunctional urethane(meta)acrylate oligomer (b2) may be one type or two or more types of urethane(meta)acrylate oligomer prepared by combining by direct urethane bond (A) polyisocyanate, which is typified by hexamethylene diisocyanate (HDI), isophorone diisocyanate (IPDI) and their isocyanurate compound, with (B) hydroxyl (meta)acrylate such as hydroxyethyl(meta)acrylate;

urethane(meta)acrylate oligomer having urethane bond at the intermediate position and (meta)acrylic acid ester structure at the end and side chains, which is obtained from the polyisocyanate, aliphatic alkylpolyol, alicyclic polyol, and polycarbonate polyol; etc.

[0013]

It is preferable that the electromagnetic ray hardening clear is further composed of electromagnetic responsive polymerization initiator (b3). The electromagnetic responsive polymerization initiator (b3) may be one type or two or more types of photopolymerization initiator such as benzophenone derivative, benzoin derivative, and anthraquinone derivative; thermal (infrared ray) polymerization initiator such as organic peroxide derivative and organic percarbonate derivative, for example.

A ratio of the components (the thermoplastic polymer (b1), the multifunctional urethane(meta)acrylate oligomer (b2), and, if necessary, the electromagnetic ray responsive polymerization initiator (b3)) contained in the electromagnetic ray hardening clear is not limited, but in terms of efficiency in forming a film, it is preferable that at least the thermoplastic polymer (b1) comprises 40% to 95% by mass of the electromagnetic ray hardening clear.

[0015]

The coloring layer (C) is for applying desired coloring to a decorated molded product so as to improve the design property. The coloring layer (C) contains, for example, a coloring component such as photo luminescent agent and coloring pigment, and, if necessary, an extender, and the like. With the coloring layer (C), it is possible to impart base shielding property and design property. Further, the coloring layer (C) preferably contains as a resin component at least one kind of conventionally known thermoplastic polymer that has excellent water resistance and chemical resistance, such as saturated acrylic resin, saturated polyester resin, and polyurethane resin, for example.

[0016]

It is preferable that the clear layer (B) is formed with a resin having a glass transition point of from 60°C to 120°C before the irradiation of an electromagnetic ray.

[0017]

The adhesive layer (D) may be further provided on the coloring layer (C). The adhesive layer (D) may be formed with known saturated polyester resin, polyurethane resin, polyamide resin, polyacrylate resin, or these resin combined with polyisocyanate cross-linking agent, for example.

[0020]

The decorating method of a three-dimensional molded product may further include the step of removing the thermoplastic protective film layer (A) of the laminate film from the clear layer (B) when necessary, after the thermoplastic protective film layer (A) achieves the objectives, namely protection and damage prevention in the decorating step.